THE RADIOACTIVE DECAY OF 2.8 DAY Sb^{122}

BY

MICHAEL JUDA GLAUBMAN

M.S., Hebrew University, 1947
A.M., University of Illinois, 1950

R. UNIV. BIBLIOTHEEK LEIDEN

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1953

URBANA, ILLINOIS

1953

THE RADIOACTIVE DECAY OF 2.8 DAY Sb^{122}

BY

MICHAEL JUDA GLAUBMAN

M.S., Hebrew University, 1947
A.M., University of Illinois, 1950

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1953

URBANA, ILLINOIS

1953

ACKNOWLEDGEMENTS

I wish to express my thanks to Professor Peter Axel for supervising the writing of this thesis, and to Professor Franz R. Metzger for suggesting this problem and for his help and encouragement throughout most of this work. I also wish to express my thanks to Mrs. Jean P. Kellom for carrying out many of the calculations, to Mr. Edward E. Wascher for his help in the maintenance of the electronic equipment, and to Professors John M. Blatt and Robert D. Hill for many interesting discussions on radioactivity.

THE RADIOACTIVE DECAY OF 2.8 DAY Sb^{122}

Summary

The 2.8 day decay of Sb^{122} was investigated using the enriched stable isotope Sb^{121} (97%). The Sb^{124} activity in the fresh sources was only 0.02% of the Sb^{122} activity. From data taken with a magnetic lens spectrometer four beta groups, with end point energies (in Mev) of 1,987, 1.423, 0.730, and 0.260, and logft values of 8.64 ($\log ft(W^2\text{-}mc^2) = 10.02$, $p^2 + q^2$ shape), 7.7, 7.7, and 6.9 respectively, and four gamma rays with energies (in Mev) of 0.563, 0.693, 1.152, and 1.256, and intensities of 73%, 3.5%, 0.75%, and 0.8%, respectively, were determined. From gamma-gamma coincidences measured with scintillation counters and with the aid of pulse height selection the excited states of Te^{122} were shown to be at 0.563 Mev, 1.256 Mev, and 1.715 Mev above the ground state. The K conversion coefficient of the 0.563 Mev transition was measured to be $5.2 \pm 0.4 \times 10^{-3}$ (E2), and the $K/(L + M + N)$ ratio was found to be 5.4 ± 0.7. The directional correlation of the 0.693-Mev — 0.563 Mev cascade was measured and found to imply a 2-2-0 cascade, the 2-2 transition being $91 \pm 5\%$ quadrupole. ($A_2 = 0.158 \pm 0.061$, $A_4 = 0.305 \pm 0.080$, where $W(\theta) = 1 + A_2P_2(\cos\theta) + A_4P_4(\cos\theta)$). Assuming that the ground state of the even-even Te^{122} nucleus is $0+$, it can be concluded that the ground state of Sb^{122} is 2- ($g_{7/2}$, $h_{11/2}$), and that the first two excited states of Te^{122} are $2+$.

VITA

Michael Juda Glaubman was born in Baltimore, Maryland, on December 31, 1924. He left this country, with his parents, in May 1934, and went to live in Petah-Tiqva, Palestine (now Israel). He entered the Hebrew University in November 1942 and graduated, with a Master of Science degree in Physical Chemistry, in November 1947. In June 1948 he came to the University of Chicago and studied in the Physics Department there till December 1948. He came to Urbana in January 1949 as a half-time research assistant in the Physics Department of the University of Illinois, and has kept that job since. He entered the Graduate Colledge of the University of Illinois in Urbana in February 1949, from which he received a Master of Arts degree in Physics in June 1950.